Experience-based Knowledge Correction for Robust Planning in Minecraft

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POSTECH

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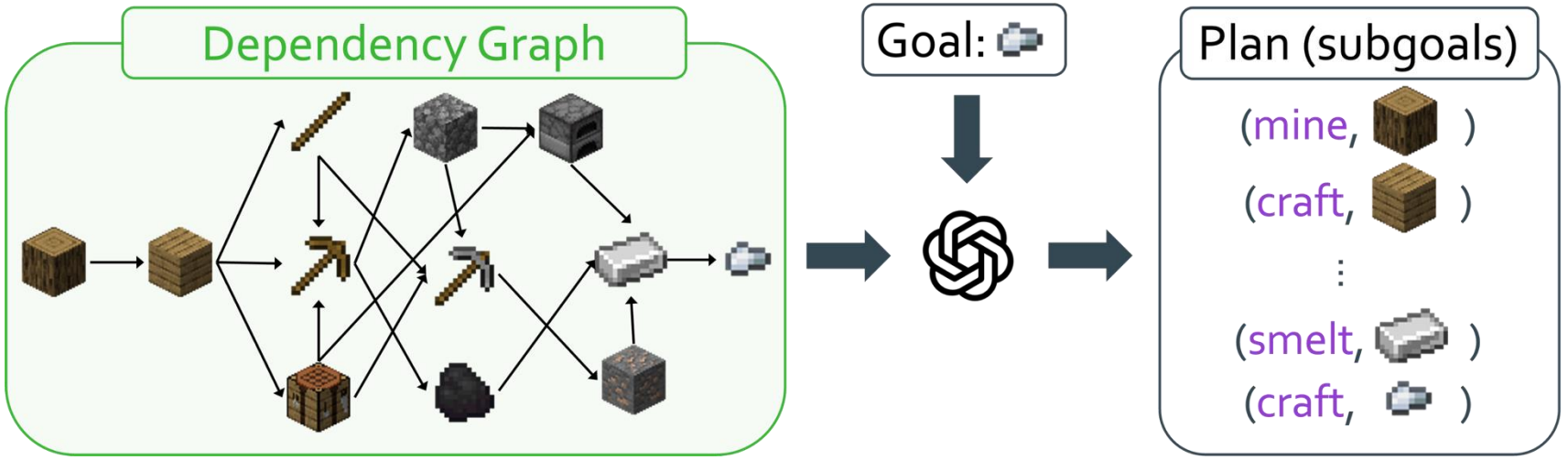
Background: LLM-based planning in Minecraft



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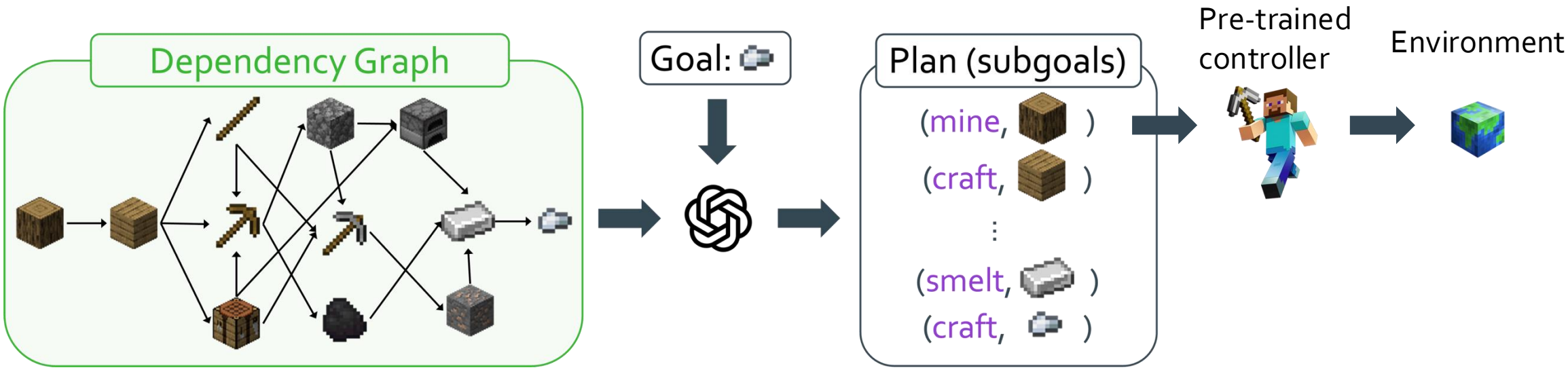

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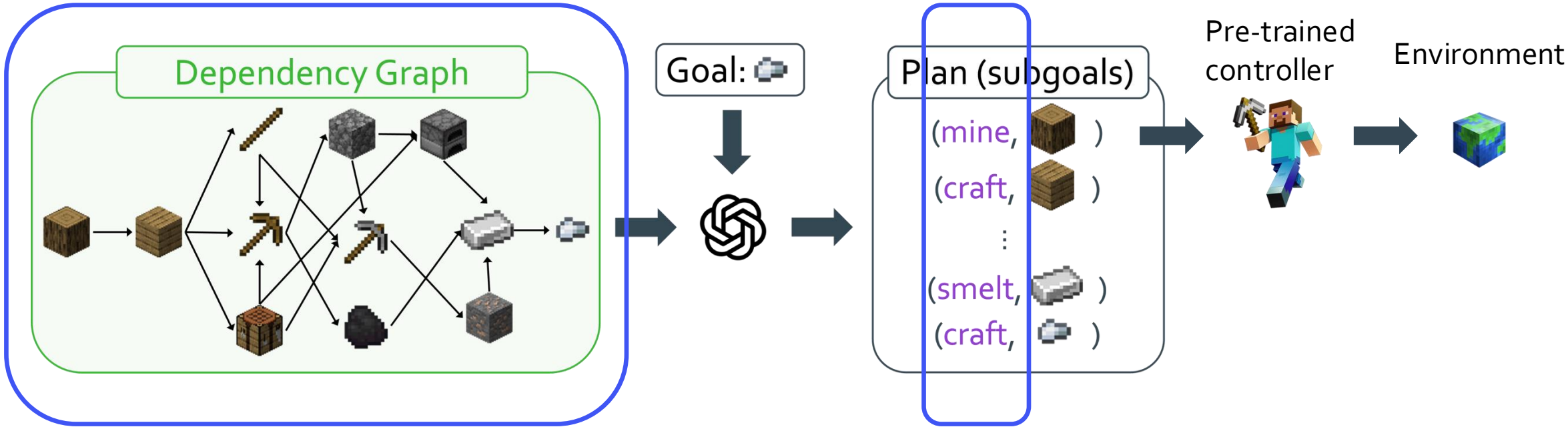

Accurate knowledge about goal item dependencies and valid actions is necessary!
Existing works assume that an LLM-based agent has correct knowledge.

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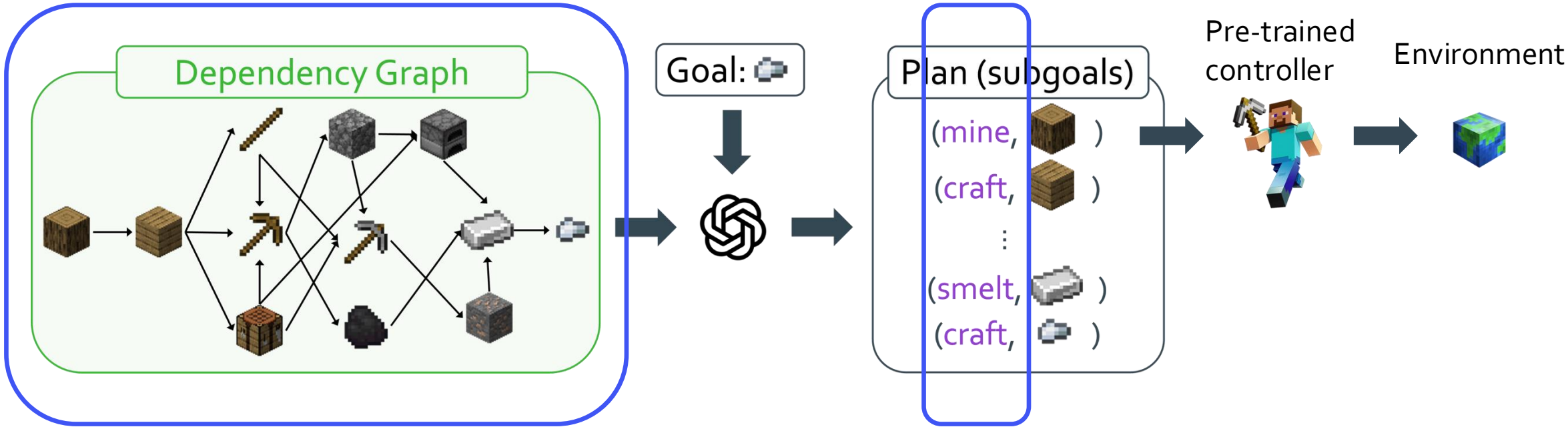

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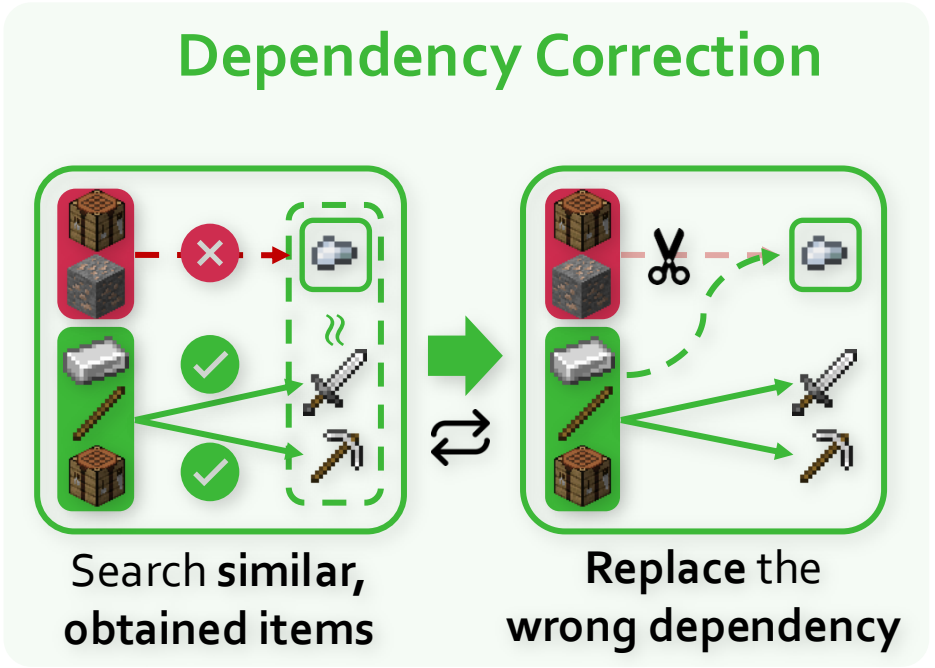
LLMs often have flawed knowledge and cannot reliably self-correct!

Idea: Knowledge correction using experience

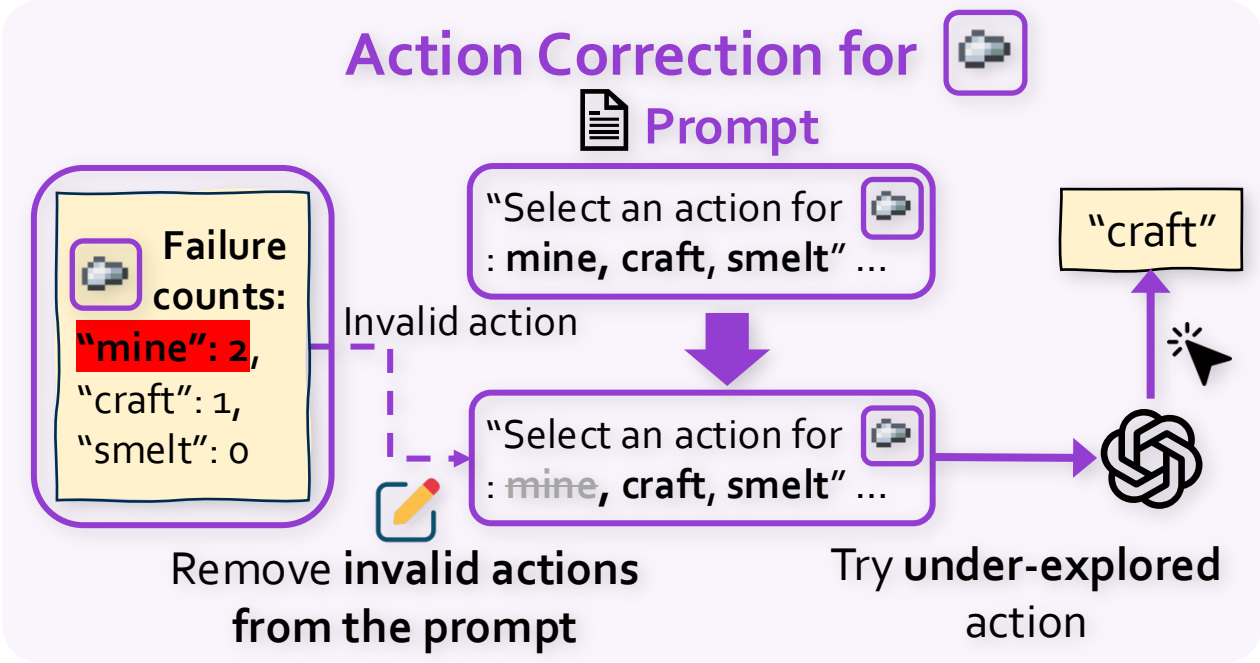
- Dependency knowledge is corrected through successful experience

repeated failures in obtaining 



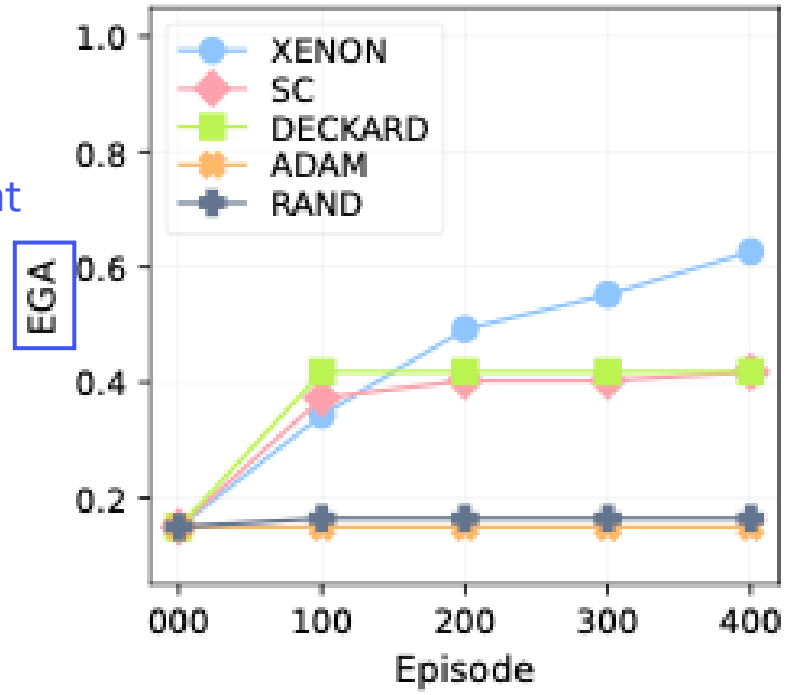
Idea: Knowledge correction using experience

- Action knowledge is corrected through failure experience



XENON corrects and learns knowledge robustly

fraction of items the agent correctly learns both dependency and action to obtain.



Environment: MineRL
LLM: Qwen2.5-VL-7B

Table 1: Comparison of knowledge correction mechanisms across agents. ○: Our proposed mechanism (XENON), △: LLM self-correction, ✗: No correction, –: Not applicable.

Agent	Dependency Correction	Action Correction
XENON	○	○
SC	△	△
DECKARD	✗	✗
ADAM	-	✗
RAND	✗	✗

XENON plans robustly against limited priors

Average success rate table.
An episode is successful if an agent obtains the specified goal item

Method	Dependency	Planner LLM	Overall	Wood	Stone	Iron	Diamond	Gold	Armor	Redstone
DEPS	-	Codex	0.22	0.77	0.48	0.16	0.01	0.00	0.10	0.00
Jarvis-1	Oracle	GPT-4	0.38	0.93	0.89	0.36	0.08	0.07	0.15	0.16
Optimus-1	Oracle	GPT-4V	0.43	0.98	0.92	0.46	0.11	0.08	0.19	0.25
Optimus-2	Oracle	GPT-4V	0.45	**0.99**	**0.93**	0.53	0.13	0.09	0.21	0.28
Optimus-1†	Oracle	Qwen2.5-VL-7B	0.34	0.92	0.80	0.22	0.10	0.09	0.17	0.04
XENON *	Oracle	Qwen2.5-VL-7B	**0.79**	0.95	**0.93**	**0.83**	**0.75**	0.73	**0.61**	**0.75**
XENON	*Learned*	Qwen2.5-VL-7B	0.54	0.85	0.81	0.46	0.64	**0.74**	0.28	0.00

- For more experiments and detailed analysis, please read our paper!